CLAIMS

1.   A method of acoustically rendering a virtual environment including:

receiving a subset of polygons derived for an acoustic display from a set of polygons generated for a graphical display;

determining acoustic reflections from a sound source that bounce off of polygons in the subset of polygons to a listener position in the virtual environment;

determining whether a polygon in the subset of polygons causes an occlusion of the sound source at the listener position; and

generating a play list of sounds based on the reflections and occlusions.

2.   A method of acoustically rendering a virtual environment as recited in claim 1 wherein the subset of polygons derived for an acoustic display from the set of polygons generated for a graphical display are derived by applying a size filter.

3.   A method of acoustically rendering a virtual environment including:

receiving a set of polygons generated for a graphical display;

selecting a first subset of the polygons for an acoustic display;

selecting a second subset of the polygons for the acoustic display;

determining acoustic reflections from a sound source that bounce off of the polygons in the first subset of polygons to a listener position in the virtual environment;

determining whether a polygon in the second subset of polygons causes an occlusion of the sound source at the listener position; and

generating a play list of sounds based on the reflections and the occlusions.

4.   A method of acoustically rendering a virtual environment as recited in claim 3 wherein the first subset of the polygons is smaller than the second subset.

5.   A method of acoustically rendering a virtual environment as recited in claim 3 wherein the first subset of the polygons is selected for an acoustic display from the set of polygons generated for a graphical display by applying a size filter.

6.   A method of acoustically rendering a virtual environment as recited in claim 3 wherein determining acoustic reflections from a sound source that bounce off of the first

subset of polygons to a listener position in the virtual environment is calculated less frequently than determining whether a polygon in the second subset of polygons causes an occlusion of the sound source at the listener position.

7.   A method of acoustically rendering a virtual environment including:

receiving a first set of polygons for a first frame of the virtual environment;

determining an occluding polygon in the first set of polygons that causes an occlusion of the sound source;

receiving a second set of polygons for a second frame of the virtual environment;

checking for a subsequent occluding polygon in the second set of polygons that cause occlusions of the sound source including:

first checking whether a second polygon in the second set of polygons that corresponds to the first polygon occludes the sound source;

in the event that the second polygon occludes the source, not checking remaining polygons in the second set of polygons for occlusions;

in the event that the second polygon does not occlude the source, checking the remaining polygons in the second set of polygons an occlusion until an occlusion is found.

8.   A method of using a polygon generated for a graphical display of a virtual environment for acoustically rendering the virtual environment including:

determining an acoustic material type for the polygon from a graphical texture included with the polygon wherein the acoustic material type includes an attenuation factor for acoustical occlusions and a reflection factor for acoustical reflections; and

determining whether the polygon occludes a virtual source in the virtual environment; and

determining whether the polygon reflects sound from the virtual source in the virtual environment toward a listener position in the virtual environment.

9.   A method of acoustically rendering reflections for a set of polygons in a virtual environment comprising:

deriving a subset of polygons from the set of polygons by applying a size filter that discards polygons smaller than a size threshold; and

increasing the apparent size of a remaining polygon to compensate for gaps left by the discarded polygons.

10. A method of acoustically rendering reflections for a set of polygons in a virtual environment as recited in claim 9 wherein increasing the apparent size of the remaining polygon includes generating a virtual reflecting source using a reflecting plane defined by extending the polygon and moving the virtual reflecting source toward the reflecting plane defined by extending the polygon.

11. A method of acoustically rendering a reflection of a source to a listener position by a polygon in a virtual environment comprising:

generating a virtual reflecting source using a reflecting plane defined by extending the polygon;

tracing a ray from the virtual reflecting source to the listener position;

determining whether the ray intersects the polygon;

in the event that the ray intersects the polygon, including the virtual reflecting source in a play list; and

in the event that the ray does not intersect the polygon, excluding the virtual reflecting source in the play list.

12. A method of acoustically rendering a reflection of a source to a listener position by a polygon in a virtual environment as recited in claim 11 further including applying a reflection factor to determine the strength of the virtual source.

13. A method of acoustically rendering a reflection of a source to a listener position by a polygon in a virtual environment as recited in claim 11 further including determining the strength of the virtual source by decreasing the strength of the virtual source according to the distance between the virtual source and the listener position.

14. A method of acoustically rendering a second degree reflection of a source to a listener position by a first polygon and a second polygon in a virtual environment comprising:

generating a first virtual reflecting source using a reflecting plane defined by extending the first polygon;

generating a second virtual reflecting source using a reflecting plane defined by extending the second polygon;

tracing a first ray from the first virtual reflecting source to the listener position;

tracing a second ray from the second virtual reflecting source to the listener position;

determining an angle between the first ray and the second ray; and

in the event that the angle exceeds a threshold angle, generating a first second order reflecting source and generating a second second order reflecting source corresponding to the second order reflections.

15.   A method of acoustically rendering a second degree reflection of a source to a listener position by a first polygon and a second polygon in a virtual environment as recited in claim 14 further including attenuating the strength of the first second order reflecting source and the second second order reflecting source by an amount that increases as the angle between the first ray and the second ray decreases.

16.   A method of acoustically rendering a second degree reflection of a source to a listener position by a first polygon and a second polygon in a virtual environment as recited in claim 14 further including attenuating the strength of the first second order reflecting source and the second second order reflecting source by multiplying the strength of the first second order reflecting source and the second second order reflecting source by the cosine of the angle between the first second order reflecting source and the second second order reflecting source.

17.   A method of acoustically rendering a set of polygons including:

grouping the polygons into a list;

determining a bounding volume that substantially surrounds the set of polygons;

determining whether a ray extending form a sound source to a listener position intersects the bounding volume;

in the event that the ray intersects the bounding volume, checking whether the ray intersects the polygons;

in the event that the ray does not intersect the bounding volume, discarding the polygons for the purpose of checking occlusions.

18.   A method of acoustically rendering a polygon between a sound source having a strength and a listener position including:

determining whether a polygon generated by a graphics rendering application intersects a ray extending form the sound source to the listener position; and

in the event that the polygon intersects the ray, attenuating the strength of the sound source.

19.   A method of acoustically rendering a polygon between a soured source as recited in claim 18 wherein attenuating the strength of the sound source includes determining an attenuation factor from a graphics texture defined in the graphics rendering application.

20.   A method of acoustically rendering a polygon between a sound source having a strength and a listener position including:

determining whether a polygon generated by a graphics rendering application intersects a ray extending form the sound source to the listener position wherein the polygon has an acoustic material type;

in the event that the polygon intersects the ray, determining whether the ray intersects a subface of the polygon; and

in the event that the ray intersects the subface of the polygon, adjusting an attenuation factor derived from the acoustic material type by a subface factor.

21.   A method of acoustically rendering a polygon as recited in claim 20 wherein the subface factor varies according to a state of the subface factor.

22.   A method of acoustically rendering a polygon as recited in claim 20 wherein the subface represents an opening in the polygon and wherein the subface factor represents an amount that the opening is activated.

23.   A method of acoustically rendering a first reflection in a first frame and a second reflection in a second frame comprising:

tagging the first reflection with a first identifier that identifies the first frame polygon that generated the first reflection;

comparing the first identifier with a second identifier that identifies the second frame polygon that generated the second reflection; and

in the event that the first identifier corresponds to the second identifier, enabling a smoothing function in an acoustic rendering system.